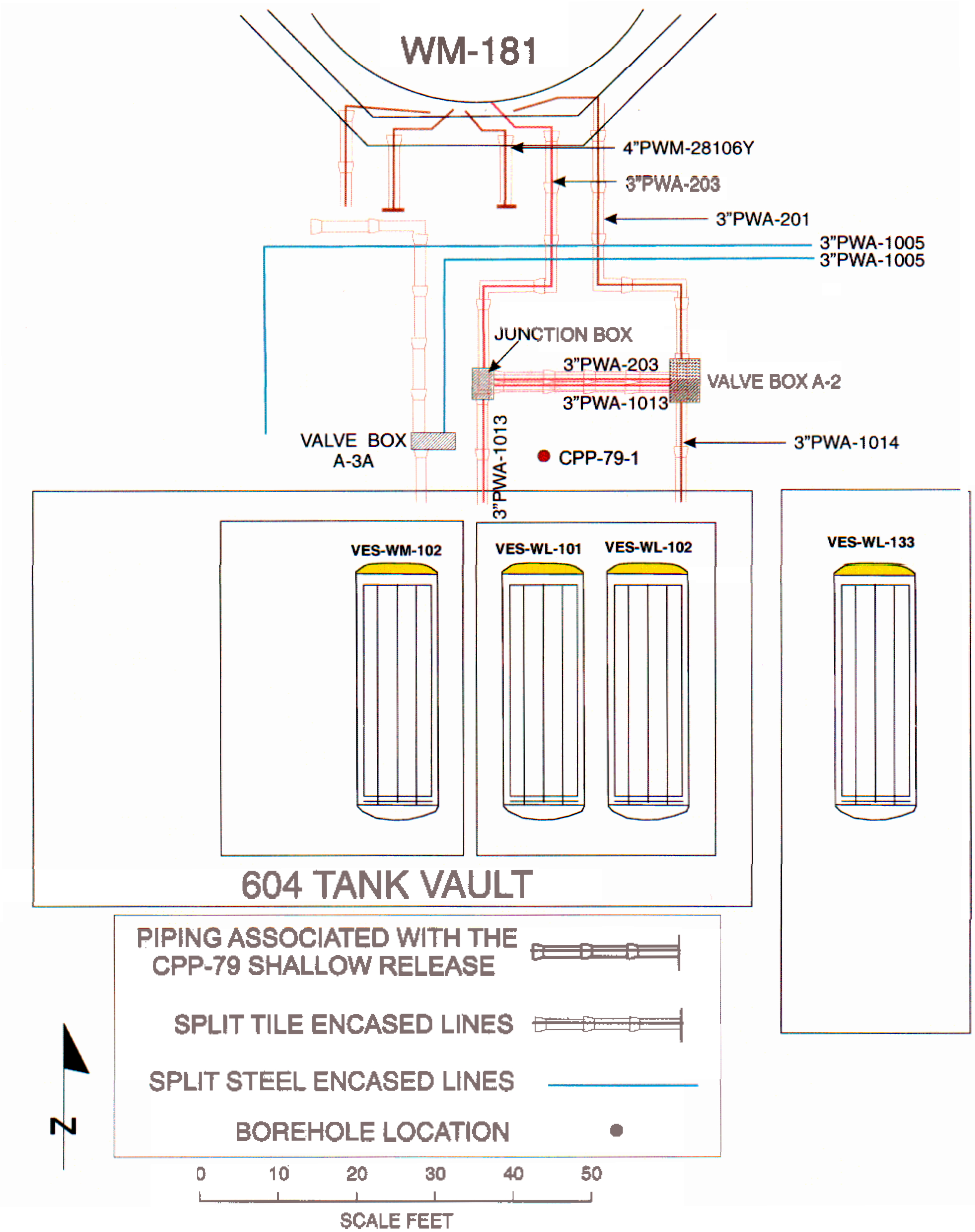

Figure 3-18. CPP-79-Shallow piping configuration.

3.1.3.1 CPP-79-Shallow Leak Description. On July 7, 1986, during a transfer from the WCF sump tank (WCF-119) to the PEW evaporator feed tank (WL-102) and again on August 2, 1986, during a transfer from the NWCF decontamination area sump tank (NCD-123), the volume of liquid received at tank WL-102 did not match the volume transferred. A systematic investigation revealed that a valve (PLV-WL-188) in the transfer line (3”PUA-10111) was partially closed, causing waste solutions to back up into valve box A-2. Drawings available at the time of the investigation did not show any connection between valve box A-2 and the waste-transfer line. Further examination of the 1954 construction prints for A-2 indicated that its drain line and valve boxes A3A, A3B, and A3C were tied into the waste-transfer line. The waste-transfer line was originally installed to allow the water used for cooling WM-180 to be transferred to WL-102, located in the CPP-604 tank vault. When A-2 was installed, its drain line was tied into this existing transfer line to WL-102.

A test was run to verify that the drain line from A-2 is actually as shown on the original construction prints and not as shown on the then-current tank farm piping diagrams. Water was placed in valve box A-2 with valve PLV-WL-188 open. An increase in monitored levels in WL-102 was observed, verifying that valve box A-2 does drain to WL-102 through 3”PUA-10111.

To determine the pathway of the water out of valve box A-2, a visual inspection of the interior of the valve box was conducted. Water was added to the waste-transfer line with all of the valves on the transfer line closed. Water was observed entering the valve box through the drain line and exited along the secondary split-tile encasement of two waste-transfer lines, 3”PUA-203 and 3”PUA-1013. Both of these lines pass through a common junction box (Figure 3-18). The lines were constructed so that any liquids in the encasement would drain toward the junction box and then toward the WL-101/102 tank vault.

Based on the results of the investigation, the missing 2,512 gal of waste from the two transfers most likely went into the soil through leaks in the split clay-tile encasement after the waste backed up into valve box A-2 and flowed to the west into the encasements of 3”PUA-203 and 3”PUA-1013 (WINCO 1986c).

3.1.3.2 Extent of Contamination at CPP-79-Shallow. An estimated 2,512 gal of dilute calciner decontamination solution generated at the WCF and NWCF was released during transfer to the PEW system. This waste contained low-level radioactivity, heavy metals, and traces of organic compounds. The decontamination solution was analyzed shortly after the release and contained the following constituents:

I-129	65,000 pCi/L
H-3	18,900,000 pCi/L
Gross beta	260,000,000 pCi/L
Uranium	0.084 ± 0.011 mg/L.

During the OU 3-07 Track 2 investigation in 1992 (WINCO 1993a), one soil borehole was drilled in the soil near the release site (borehole CPP-79-1; see Figure 3-18). The borehole location was on a berm approximately 8 ft above the ground surface in the tank farm. As a result, the original land surface elevation corresponds to a depth of 8 ft bgs in the borehole. In the subsequent discussions, the depths have been adjusted to correspond to the tank farm land surface and not that of the berm.

Fifteen split-spoon samples were collected from CPP-79-1 and screened for gross beta-gamma radiation. Seven samples were selected from the zones having the highest radiation readings for further analysis. Two of the seven samples were duplicates collected between 24 and 28 ft bgs. One sample collected from the 33.5- to 34-ft interval had significantly higher radiation levels. Based on field monitoring and soil analytical results from borehole CPP-79-1 (Figure 3-19), there appear to be two distinct radionuclide contaminant zones that probably originated from different sources. The uppermost zone was encountered between 14 to 22 ft bgs (CPP-79-Shallow). This zone was characterized by gross alpha emissions slightly in excess of background levels and by gross beta emissions up to eight times the background level. The radionuclides found in this zone are attributed to the release of low-level decontamination solution associated with the CPP-79-Shallow release site. The top of the second radionuclide-contaminated zone was encountered in CPP-79-1 at a depth of approximately 31 ft. This zone is characterized by radionuclide concentrations that are two to three orders of magnitude greater than those detected in the shallow zone and may be the result of a release of first-, second-, and/or third-cycle wastes (Table 3-5). All samples associated with the CPP-79-Shallow release were analyzed for gross alpha-emitting and gross beta-emitting radionuclides. Samples collected above 28 ft bgs had relatively low activities of radionuclides, consistent with a release of WCF and NWCF decontamination solutions. Gross alpha activity was below background levels in samples collected below 16 ft bgs and above 28 ft bgs. Gross beta and Cs-137 activities remained above background levels from 14 to 22 ft bgs. The soil samples collected from 24 to 28 ft bgs contained radionuclides near or below background levels.

The highest gross alpha, beta, and Cs-137 activities observed for the shallow release site were from the sample collected from 14 to 16 ft bgs. The Cs-137 concentration in this sample was 20.9 ±1.5 pCi/g; the Sr-90 activity was 54.4 ±3.46 pCi/g. This sample also had detectable levels of U-238 and -235 that were near background levels and Pu-238 and -239 levels that were slightly above background concentrations. INEEL background levels for U-238, Pu-238, and Pu-239/240 have been determined to be 1.40, 0.0049, and 0.10 pCi/g respectively (INEL 1996).

Information on the lateral extent of the contamination around borehole CPP-79-1 is provided by the results of samples from boreholes A-61 and -62 (LITCO 1995a). These boreholes were drilled to the west and east, respectively, of borehole CPP-79-1 (Figure 3-20).

Soil samples were collected and analyzed from depths of 28.5 to 30.5 ft and 38.5 to 40.3 ft in borehole A-61. The highest gross alpha (1,230 ±20 pCi/g), gross beta (20,500 ±50 pCi/g), Sr-90 (3,360 ±30 pCi/g), and Cs-137 (25,000 ±2,000 pCi/g) concentrations were in the 28.5- to 30.5-ft sample from borehole A-61. Other radionuclides detected in this sample include Am-241 (46 ±4 pCi/g), Pu-239/240 (319 ±10 pCi/g), and U-234 (2.1 ±0.1 pCi/g). Concentrations of these same constituents in the 38.5- to 40.3-ft sample were one to four orders of magnitude lower than in the shallower sample.

Samples were obtained from 2 to 4 ft and 40.3 to 41.8 ft in borehole A-62. Concentrations of Sr-90 and Cs-137 in the near-surface soil sample from borehole A-62 were 305 ±3 pCi/g and 730 ±5 pCi/g, respectively. Concentrations of these radionuclides were below background in the deeper sample from borehole A-62. A comparison of ratios of the detected radionuclides in the sample from borehole A-61 with the results from samples from borehole 79-1 (Table 3-5) indicate that some similarities exist between the contamination, but not enough to determine if the contamination observed in A-61 originated from the same source as CPP-79-Deep. Borehole A-61 is farther from the known release location for the shallow contamination present in CPP-79-1 observed at 22 to 24 ft bgs, yet this borehole had higher concentrations for most contaminants, indicating that the release of dilute calciner decontamination solutions at CPP-79-Shallow is not the source of contamination in A-61.

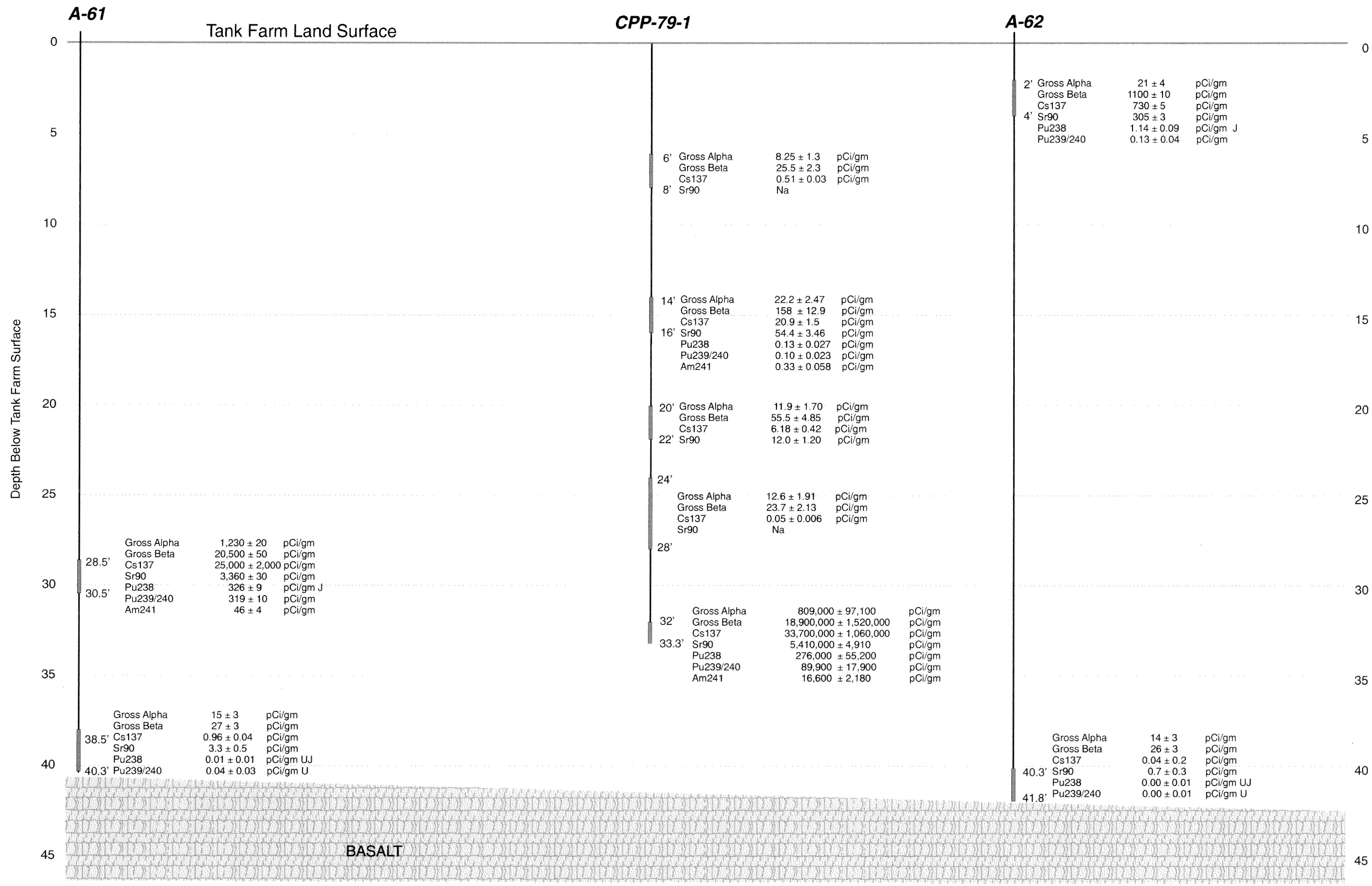

Figure 3-19. West-to-east fence diagram through A-61, CPP-79-1, and A-62 showing soil sample analytical results.

Table 3-5. Borehole sample result comparison table (results in pCi/g).

Radionuclides and Associated Ratios	Borehole CPP-79-1-Shallow (14–16 ft bgs)	Borehole CPP-79-1-Deep (32–2.5 ft bgs)	Borehole A-61 (28.5–30.5 ft bgs)	Borehole A-62 (2.0 – 4.0 ft bgs)
Radionuclides				
Gross alpha	22.2	809,000	1,230	21
Gross beta	158	18,900,000	20,500	1,100
Cesium-137	20.9	33,700,000	25,000	730
Sr-90	54.4	5,410,000	3,360	305
U-234	5.55	ND	2.10	1.42
U-238	1.39	ND	1.50	1.67
Pu-238	0.13	276,000	326	1.14
Pu-239/240	0.10	89,900	319	0.13
Am-241	0.33	16,600	46	R
Ratios of detected radionuclides				
Gross beta/gross alpha	7.1	23.4	16.7	52.4
Gross beta/Sr-90	2.9	3.5	6.1	3.6
Cs-137/Sr-90	0.4	6.2	7.4	2.4
Pu-238/(Pu-239/240)	1.3	3.1	1.0	8.8
Sr-90/(Pu-238 + Pu-239/240)	236	11.8	5.2	240

ND – Not detected; uranium activity could not be quantified in the presence of the large amounts plutonium isotopes in the sample.

R – Result was rejected because of an out-of-control quality control parameter.

Because the release at site CPP-79-Shallow was from a known source, the source term can be bounded based on knowledge of the volume of liquid lost and the waste stream. The estimated curie content contained in the 2,512-gal release was 7.0 Ci (Cs-137 and Sr-90) based on 1986 laboratory analytical data from PEW waste stream acceptance testing completed on the two waste streams.

Most of the contaminated soil at the CPP-79 Shallow site is believed to have been removed from the release location and stockpiled during the 1993-1994 tank farm upgrade project. The amount of activity was not documented during the excavation activities. Figure 3-21 shows a north-south cross section through the CPP-79-Shallow release site. This figure was used for planning purposes, and the shoring shown in the figure may not have been used, opting for sloped sidewalls instead. Soil was excavated down to approximately 30 ft below the tank farm surface. Reportedly, the majority of the soils excavated and stockpiled during the 1993-1994 tank farm upgrade were placed back into the excavation, but it is not documented where the soils from the CPP-79 Shallow release were used as backfill. Therefore, the

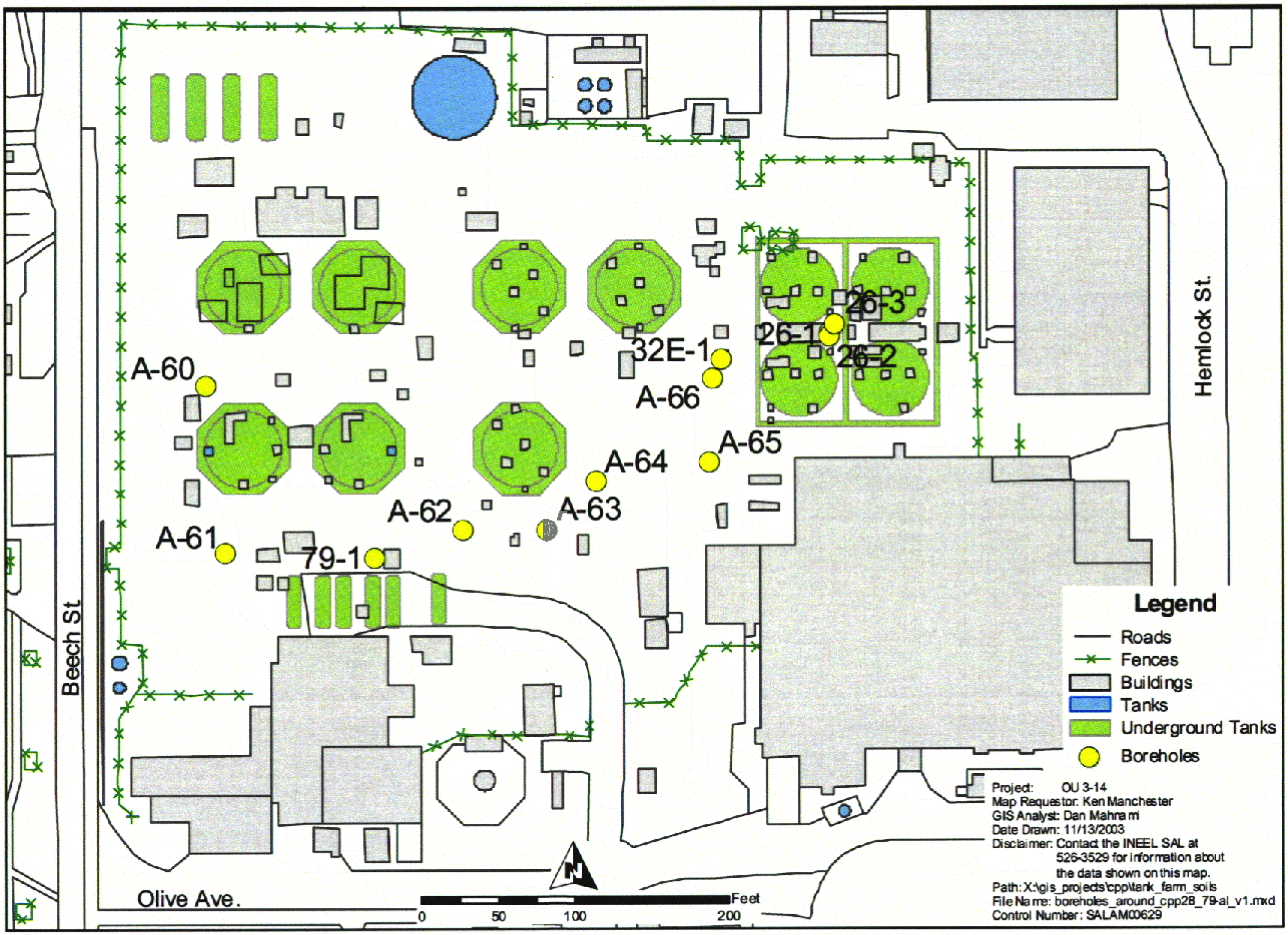

Figure 3-20. Map of the tank farm showing locations of boreholes drilled near CPP-79.

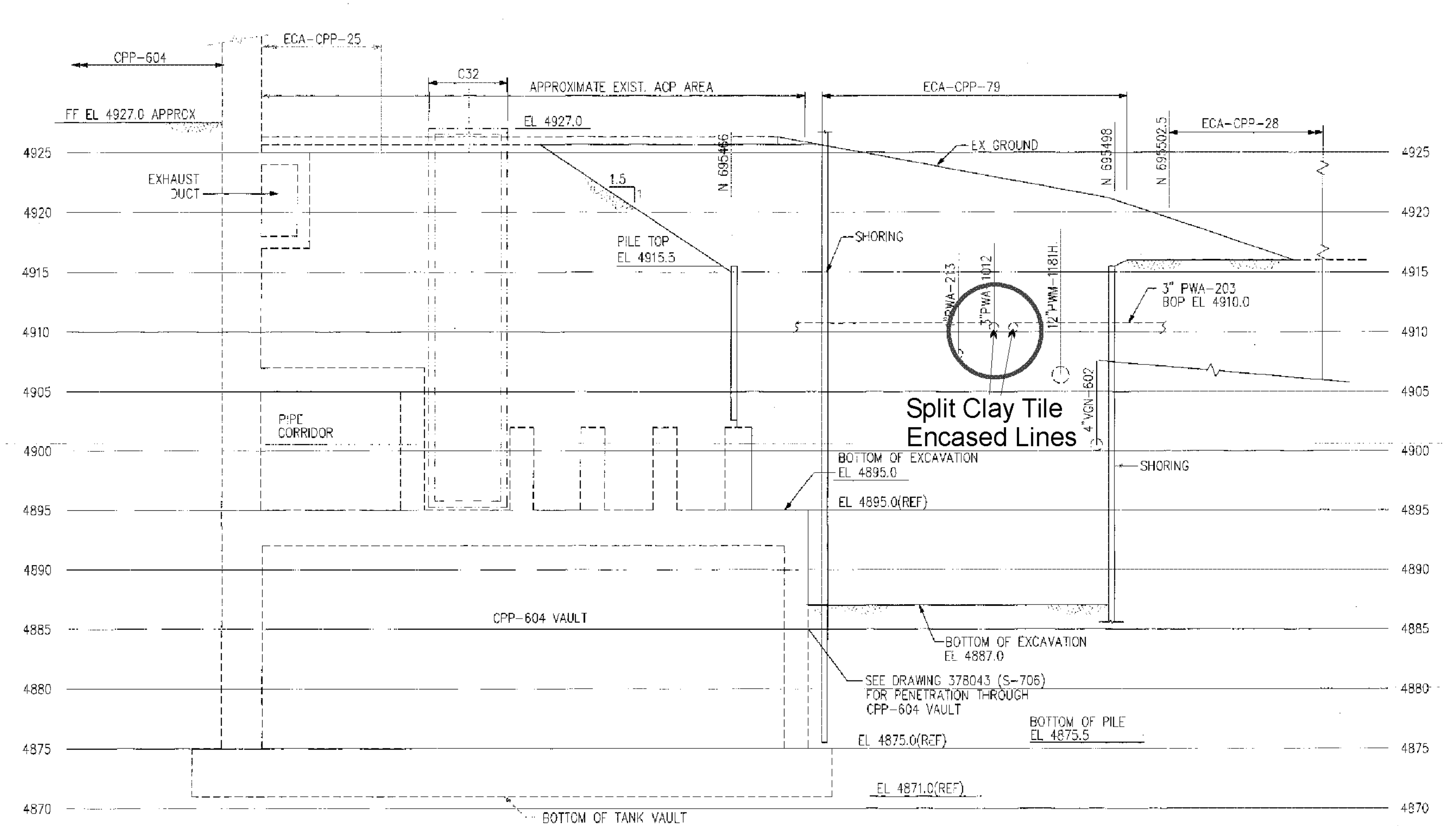

Figure 3-21. Cross section through CPP-79 release site showing planned excavation depths.

contamination from this release is assumed to still exist in the tank farm and will be included as a part of the source term.

3.1.3.3 Site CPP-79-Deep Investigation and Leak Description. As mentioned in the previous section, one soil boring, CPP-79-1, was installed near the CPP-79 release site (see Figure 3-18) on a berm approximately 8 ft above the ground surface of the tank farm.

The soil sample collected from 33.5 to 34 ft bgs had significantly higher levels of radiation than shallower samples and at the time was too radioactive to be analyzed by either on-Site or off-Site analytical laboratories. This sample had a contact surface radiation level of 400 mR/hr beta-gamma. (This radiation level is considerably lower than the 400 R/hr value presented in the *Track 2 Summary Report for Operable Unit 3-07* [WINCO 1993a] and the OU 3-14 Tank Farm Soil and Groundwater Phase I RI/FS Work Plan [DOE-ID 2000b].) After careful review of the CPP-79 field logbook, the highest measured radiation level was determined to be 1.2 R/hr, which was measured from a sample collected from the 32- to 33.3-ft depth interval at the open end of the split-spoon sampler. Subsequent measurements taken in the laboratory where the split-spoon sampler was disassembled under controlled conditions ranged from 400 to 800 mR/hr beta-gamma and 200 to 300 mR/hr beta. The values documented in the logbook (mR/hr) were reported in subsequent documents as R/hr, leading readers of the reports to believe there was extremely contaminated soil at CPP-79. The sample collected from the 33.5- to 34.0-ft interval was disposed down the borehole near the depth from which it originated.

The radionuclide analysis of the sample collected from 32 to 32.5 ft bgs measured significantly higher gross alpha (8.09E+05 ±9.71E+04 pCi/g) and beta (1.89E+07 ±1.52E+06 pCi/g) activities than were measured in sample intervals above 24 ft bgs (Figure 3-19). Isotopic analysis of this soil also detected significantly higher concentrations of Cs-137 activities (3.37E+07 ±1.06E+06 pCi/g), Sr-90 (5.41E+06 ± 4.91E+03 pCi/g), Pu-238 (2.76E+05 ± 5.52E+04 pCi/g), Pu-239 (8.99E+04 ± 1.79E+03 pCi/g), and Am-241 (1.66E+04 ± 2.18E+03 pCi/g) than in shallower sample intervals. The isotopic plutonium results for the samples collected at CPP-79-1 were originally reported as unusable in the *Track 2 Summary Report for Operable Unit 3-07 (Tank Farm Area 1)* (WINCO 1993a) due to a 0.0% yield of the chemical tracer. Inquiry to the laboratory by the Sample Management Office found that the percent yields for sample analyses were incorrectly reported and were actually approximately 50%. Therefore, the results were considered usable and were reported in the *Report of the 1993/1994 Tank Farm Drilling and Sampling Investigation at the Idaho Chemical Processing Plant* (LITCO 1995a). The analysis led investigators to conclude that the deeper contamination is not from the reported WCF and NWCF decontamination solutions associated with site CPP-79-Shallow. The deeper zone of contamination appears to be the result of a release of first-, second-, or third-cycle raffinates.

The source of the deeper contamination has not been determined, but one potential leak mechanism was identified for the release of contaminants into the soils. Previous documents have linked the CPP-79-Deep contamination to the CPP-28 release because the deeper soil was extremely contaminated. However, three lines of evidence suggest that the two zones of contamination are not associated with each other. First, contaminant concentrations found at the CPP-79-Deep site are not as high as previously documented, suggesting that the source does not necessarily have to be from first-cycle waste, as was released at CPP-28. Second, interviews with tank farm operations staff indicated that during the 1993–1994 tank farm upgrades, the area between CPP-28 and CPP-79 was extensively excavated and, to their knowledge, did not encounter areas or pathways between the two locations having highly contaminated soil, suggesting the two sites are independent. Finally, the extent of contamination at CPP-28 appears to be reasonably bounded—contained within a relatively small volume beneath the former location of the 3”PWA-1005 waste-transfer line (see Section 3.1.1.2).

The likely leak mechanism for CPP-79-Deep is associated with the A-3A valve box. During the CPP-28 leak investigation, associated piping and valve boxes were inspected for signs of leakage. According to an incident report on contaminated soil at the tank farm, valve box A-3A was examined and found to have 1 to 2 in. of radioactive solution with a reading of 25 R/hr in the bottom, and the bottom drain line to the PEW collection tank was plugged (Allied Chemical 1975a). A ring of dried chemical salt residue was readily visible inside the concrete box at the approximate level of the center line for the pipe sleeve for exit pipe line 3"PWA-1030 (the 1975 report incorrectly identified this line as 3"PWM-2016Y), indicating that the liquid had been at that level for some time. Valve and flange gaskets were found to be of Teflon and in a high state of disintegration. The solution in the bottom of the box was sampled, and analysis indicated the solution was first-cycle waste generated from aluminum fuel rod reprocessing.

Secondary containment for 3"PWA-1030Y was the split clay tile encasement that drained into the CPP-604 tank vault. Leakage from the valve in valve box A-3A may have accumulated inside until the fluid level reached the opening of the tile encasement. With continued leakage, the waste fluid would begin to flow down vertically toward the bottom of the encasement located approximately 26 ft bgs and start to degrade the tile joints on contact, eventually allowing leakage into the surrounding soil. A slightly different possibility exists, allowing waste liquids to pass through the split clay tile encasement. The design of the concrete-covered split clay tile encasement created a very rigid structure. If any differential settling of soils occurred, the encasement would be susceptible to cracking, creating pathways for liquid waste to move into the soil. The area in the vicinity of A-3A has been disturbed a number of times, which may have caused differential settling around the valve box. The depth of release is consistent with the deep contamination observed in CPP-79-1.

3.1.3.4 CPP-79-Deep Extent of Contamination. Only one soil sample has been collected from the deep contamination zone at CPP-79-Deep. Once contaminated soil was encountered at borehole CPP-79-1 at 32 ft (40 ft from the top of the berm), drilling was halted. Excavations made during tank farm upgrades in the CPP-79 release area have gone as deep as 32 ft below grade and reportedly encountered contaminated soil with radiation levels as high as 5 R/hr.[b] In 1993, two additional boreholes, A-61 and A-62, were installed where contamination was detected, as discussed in Section 3.1.3.2. Comparing ratios of the detected contaminants from A-61 to the deep contamination in CPP-79-1, no evidence indicates the two contaminant zones have the same source (LITCO 1995a). In particular, the ratio for the Pu-238 and Pu-239/240 for CPP-79-1 is 3.1, while the ratio in A-60 is 1.0. If the contamination was the result of the same release, the ratio of the plutonium isotopes would be essentially equal. Additionally, the ratio of Cs-137 to Sr-90 is 6.2 for CPP-79-1 and is 7.4 for A-61. This would only be expected if the contamination was moving from A-61 to CPP-79-1 due to the difference in K_d values for these two contaminants. But the relative concentrations of radionuclides detected do not support this direction of contaminant transport. The results from A-61 and -62 help bound the extent of contamination in CPP-79-Deep. The contamination encountered at A-61, having contact radiation levels of 10 to 12 mR/hr, is believed to be from contaminated backfill.

Two estimates, an upper and lower, were made to help estimate and bound the Cs-137 and Sr-90 curie content of this deep contamination zone. The estimates were made based on the location and depth of the suspected release mechanism located approximately 5 ft above and 15 ft laterally from the contamination observed in borehole CPP-79-1 at 32 to 33.3 ft bgs. The low estimate was made by assuming that the contaminated soil mass formed an oblate dome shape with a radius of 16 ft and a height of 6 ft. The volume associated with this shape was calculated to be 2,827 ft^3. Because the suspected leak mechanism is located next to the CPP-604 tank vault, only half of the oblate dome volume, or 1,414 ft^3, would be in soil. The other half would extend into the impervious tank vault structure, limiting the shape

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b. Personal communication from D. Machovec, Bechtel BWXT Idaho, LLC, to K. Manchester, MSE Technology Applications, Inc., and A. Bailey, PS2 Associates, September 9, 2003.

of the release. Assuming 6% soil moisture by volume, the amount of liquid waste contained in the contaminated volume would be 84.8 ft^3 or 634 gal. Assuming that the waste was first-cycle raffinates with a Cs-137 and Sr-90 curie content of 6 Ci/gal based on analytical data for first-cycle waste, the lower release estimate becomes 3,804 Ci of combined Cs-137 and Sr-90.

The upper estimate was made based on the release again forming an oblate sphere shape with a radius of 40 ft and a height of 12 ft, extending the contamination to the base of the alluvium. The volume calculated for this waste configuration was 10,053 ft^3. Again, reducing this volume by half due to the presence of the CPP-604 tank vault results in a volume of 5,027 ft^3. Assuming 6% soil moisture by volume, the amount of liquid waste contained in the contaminated volume would be 301.6 ft^3 or 2,256 gal. Assuming that the waste was first-cycle raffinates with a Cs-137 and Sr-90 curie content of 6 Ci/gal based on analytical data for first-cycle waste, the upper release estimate becomes 13,535 Ci of combined Cs-137 and Sr-90.

3.1.4 Site CPP-15

Site CPP-15 was the location of the Solvent Burner Building (CPP-629) (Figure 3-22). Operation of the facility began in the late 1950s and it was dismantled in 1983. The spent organic solvent, either hexone (methyl isobutyl ketone) or TBP and purified kerosene, which was burned in the building, came from the uranium solvent extraction processes. Solvent extraction was used to separate uranium from fission products. The solvent was put in contact with uranium contained in an aqueous solution of uranyl nitrate that was produced in the fuel dissolution process.

The spent solvent, which had a very low radionuclide content, was burned in a standard furnace oil burner in a fire-brick-lined enclosure fed by an underground solvent feed tank (LE-102) located below the building. Based on facility drawings, the tank size was 4 ft in diameter and 7 ft long, and it had an approximate volume of 650 gal. The furnace off-gases were sent unfiltered to the INTEC main stack. A 1977 analysis of soot taken from the flue detected I-129 (6.67E-02 pCi/g), Pu-239 (3.85E-00 pCi/g), Am-241 (6.25E-02 pCi/g), Cs-137 (1.32E+01 pCi/g), Ba-137m (2.94E-02 pCi/g), and Ru-106 (3.38E+01 pCi/g). Small amounts of flue soot and condensate may have been released over the years of operation, contaminating the soil immediately east of building CPP-629.

On March 28, 1974, during maintenance of the solvent burner, liquid was reportedly found on the ground inside and outside the Solvent Burner Building (CPP-629). As part of the construction work for the new PEW evaporator, a section of the drain line from the main INTEC stack had been cut out. Valves had been installed at each end of the cut, and a section of temporary hose was installed between the valves. During the day shift, the valves were closed, and the section of hose was removed, allowing free access to the area. At the end of working hours, the hose section would be replaced and the valves opened, permitting the line to function as a drain during the night. An overlooked jetted line from the solvent feed tank (LE-102) to the stack drain used to transfer water out of the tank was found to exist during the construction activity. Condensate from the stack backed up the jet line to LE-102, causing it to overfill. The leak of the spent solvent was determined to have occurred from the ground surface flange directly above the solvent feed tank. The quantity of spilled liquid is unknown. Beta and gamma radiation readings as high as 3 R/hr were reported to have been detected in the contaminated soil outside the building, which was removed and placed in drums. Uncontaminated soil was used to backfill the excavation.

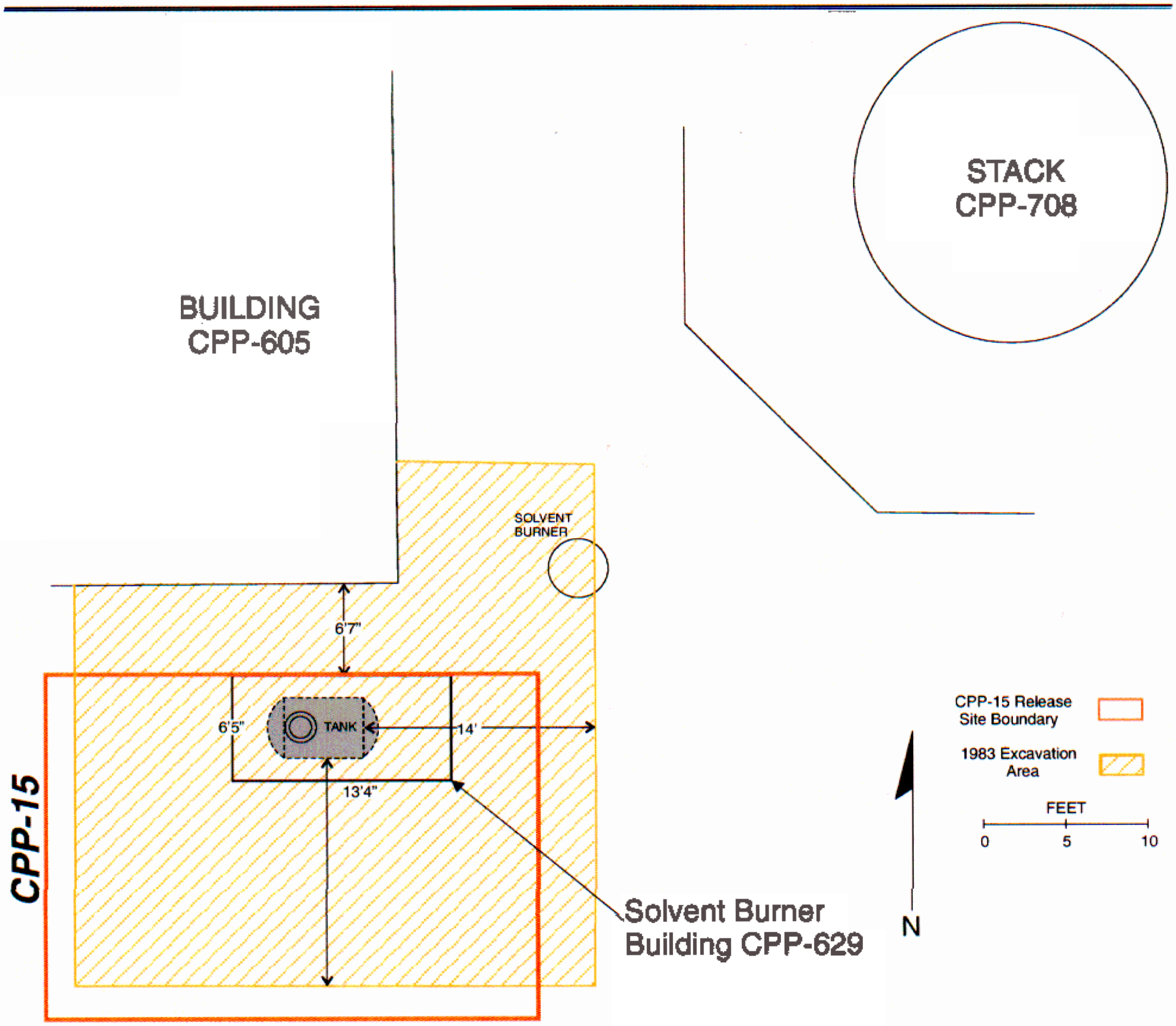

Figure 3-22. Site CPP-15 location map.

Demolition of the Solvent Burner Building in 1983 included removal of the furnace/burner unit; the furnace duct; the control shed; the piping, valves, and controls within the shed; the piping penetrating the shed; the solvent feed tank (LE-102); and the contaminated soil in the area (Figures 3-22 and 3-23). Interviews with personnel involved in the demolition indicated that the soil excavation exceeded 10 ft below grade and was very thorough. No post-excavation sampling was performed to confirm the removal of contamination. Site CPP-15 was originally included in OU 3-08, which underwent a Track 2 investigation (WINCO 1993b). The Track 2 investigation was performed on the basis of information about the demolition and removal activities. Sampling and analysis were not performed.

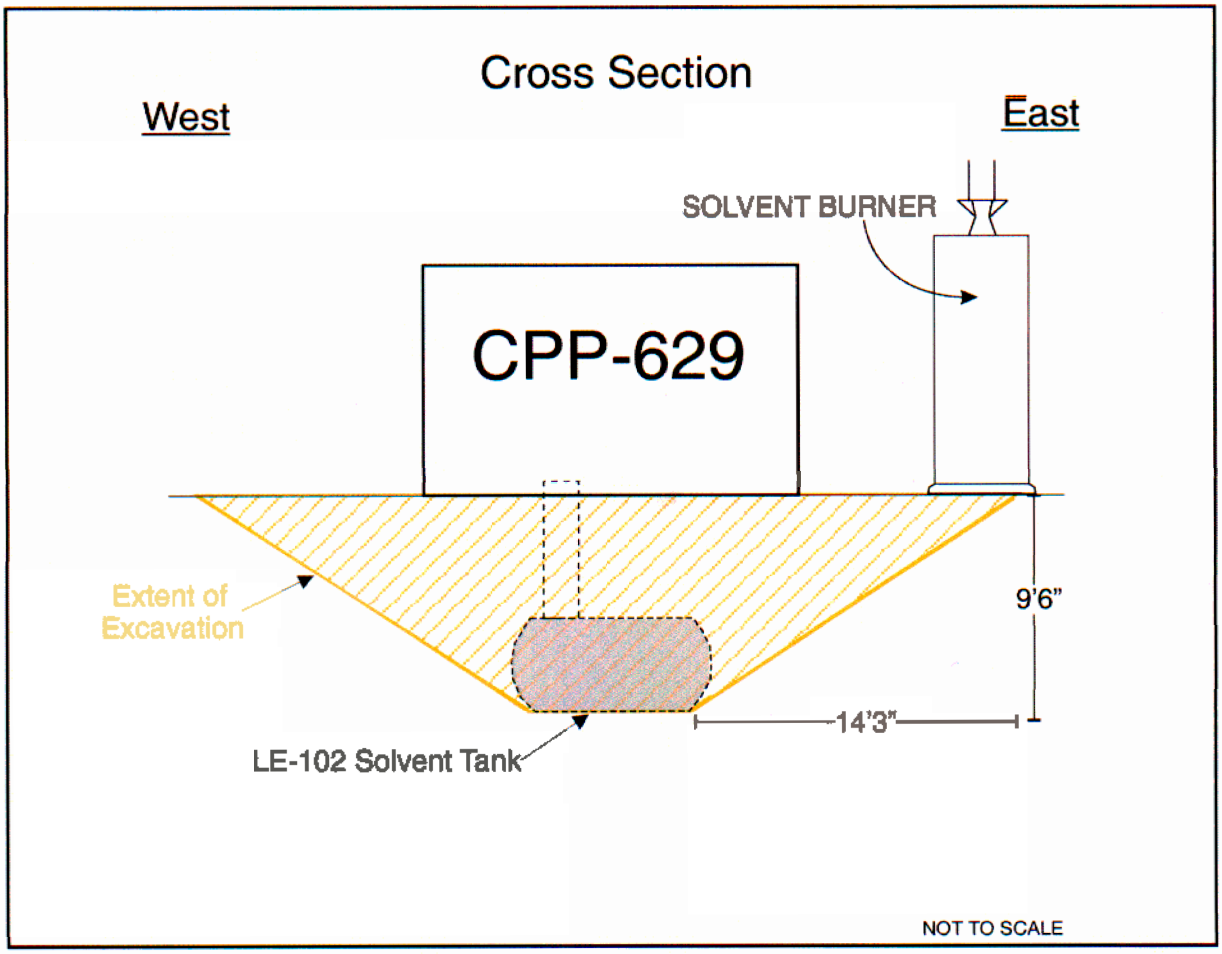

Figure 3-23. Cross section showing the general shape of the 1983 excavation to remove solvent tank.

Site CPP-15 was recommended for No Further Action. In September 1995, construction personnel encountered elevated radiological readings while excavating soil in the western portion of the CPP-15 site. The excavation was in support of installation of an electrical duct bank and transformer pad. The contaminated soil was encountered at a depth of 2 ft. One spot on a concrete footing beneath the contaminated soil had a reading of 1.5 R/hr. The footing was a remnant of the old stack pre-heater. Six soil samples were collected in the area of the contaminated footing from the following five locations:

- A stockpile of excavated soil in a dump truck (sample CPP-15-1)
- Soil approximately 1.5 ft away from the footing at 2 ft bgs (sample CPP-15-2)
- Soil directly below the footing (samples CPP-15-3 and duplicate CPP-15-5)
- Soil 4 ft below the footing, 6 ft below land surface (sample CPP-15-4)
- Soil 8.5 ft below the footing, 10.5 ft below land surface (sample CPP-15-4D).

The locations where the soil samples were collected are shown on Figure 3-24. Analytical results of the six samples are presented in Table 3-6. No other analyses are known to have been performed.

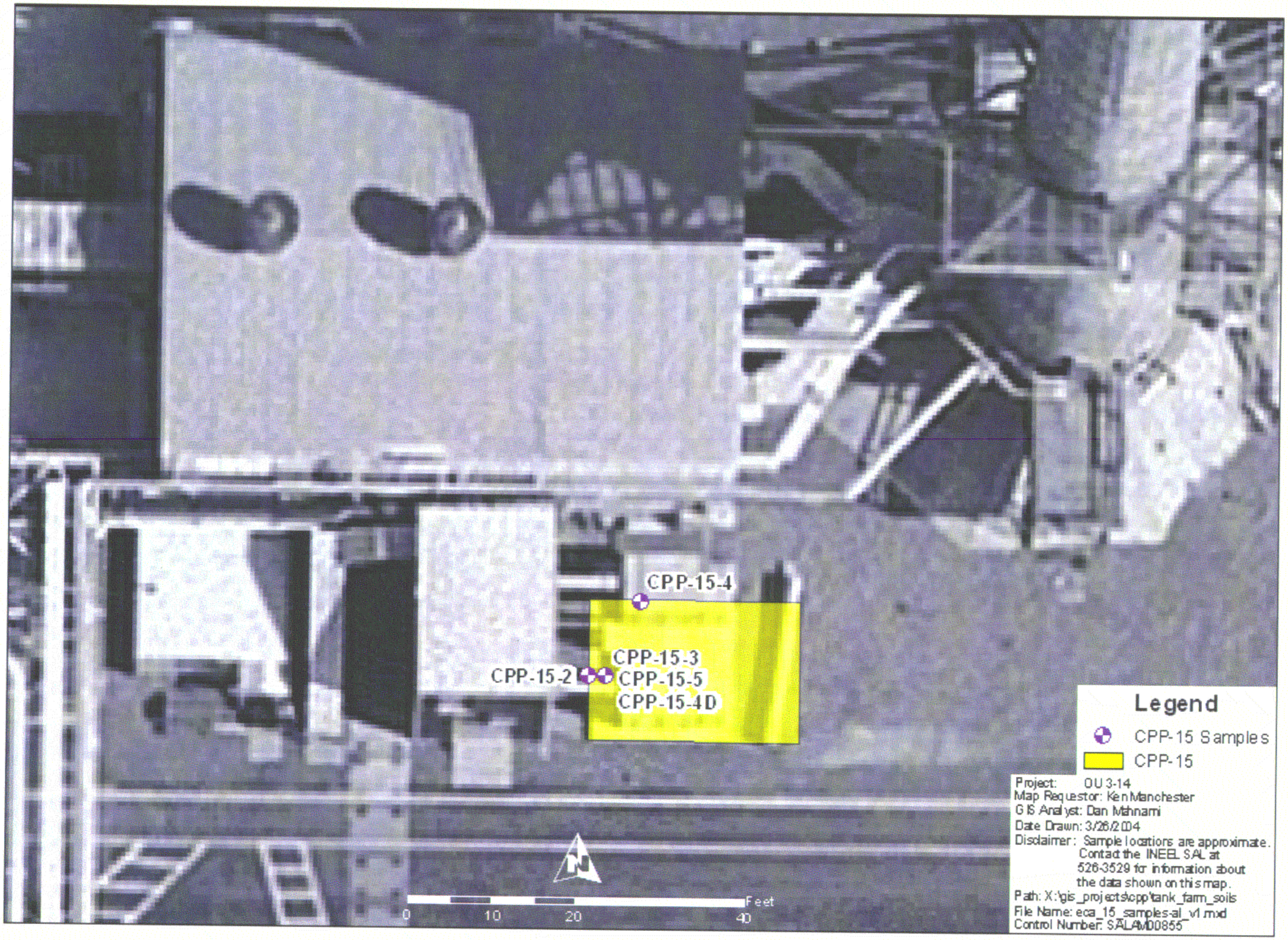

Figure 3-24. CPP-15 sample location map for soil samples collected in 1995.

Table 3-6. Analytical results for soil samples collected during the 1995 construction activities at CPP-15 (DOE-ID 1997a).

Sample Number	Sample Depth (ft)	Am-241 (pCi/g)	Cs-137 (pCi/g)	Sr-90 (pCi/g)	Eu-154 (pCi/g)	Np-237 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Tc-99 (pCi/g)	U-233 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	Gross Alpha (pCi/g)	Gross Beta (pCi/g)
CPP-15-1	0.0 – 3.0 (Truck bed composite)	ND	44.5 ± 7.7	16.4	NA	ND	0.57 ± 0.16	ND	7.41	23.5	0.02	0.26	ND	84.7
CPP-15-2	2.0	3.42 ± 0.42	2,810 ± 140	727	NA	ND	22.7 ± 1.6	4.30 ± 0.50	7.24	47.9	0.03	0.36	84	3,500
CPP-15-3	2.0	2.42 ± 0.42	2,350 ± 120	617	NA	ND	19.6 ± 1.3	3.44 ± 0.38	4.15	243	0.06	0.28	75.9	2,970
CPP-15-5 (dup)	2.0	15.8 ± 1.6	43,400 ± 1,800	4250	NA	ND	93.3 ± 4.6	16.9 ± 1.2	5.89	18.2	0.01	0.29	1,090	48,100
CPP-15-4	6.0	19.6 ± 1.9	15,420 ± 850	7990	NA	0.47 ± 0.12	112 ± 5.4	19.8 ± 1.3	6.17	23.7	0.02	0.31	462	27,700
CPP-15-4-D	10.5	538 ± 35	586,000 ± 17,000	DNF	243 ± 24	0.63	4,570 ± 320	825 ± 63	36.7	DNF	0.0203	DNF	5,680	778,000

Note: The following radionuclides were analyzed for but not detected at the site: Co-60, Cs-134, I-129, Ru-103, Ru-106, U-234, U-236.

ND = Not detected.

NA = Not analyzed.

DNF = Data not found.

The 1995 soil sampling analytical results indicate that the highest levels of radionuclide contamination were present in the samples collected 8.5 ft below the contaminated footer, which is 10.5 ft below grade. This would suggest that not all of the contaminated soil was removed during the 1983 demolition activities and is consistent with the report that the excavation extended only to 10 ft below grade. Cs-137 was the only radionuclide detected in the four shallow soil samples during an analysis for gamma-emitting radionuclides. The detected concentrations ranged from 2,350 ± 120 to 43,300 ± 1,800 pCi/g. In addition to gamma spectroscopy analysis, the sample from 10.5 ft below grade was analyzed for a suite of other radionuclides, including I-129, Np-237, total strontium, Tc-99, plutonium, and uranium isotopes. The Cs-137 activity in the sample was 586,000 ± 170,000 pCi/g. Other radionuclides detected in the sample were Am-241 at 538 ± 35 pCi/g, Eu-154 at 243 ± 24 pCi/g, Np-237 at 0.63 pCi/g, Pu-238 at 4570 ± 320 pCi/g, Pu-239/240 at 825 ± 63 pCi/g, Tc-99 at 36.7 pCi/g, and U-235 at 0.0203 pCi/g. I-129 was not detected.

All of the soil samples were subjected to analysis for metals, cyanide, sodium, potassium, semivolatile organic compounds (SVOCs), percent solids, and volatile organic compounds (VOCs) as well. Zirconium was detected in all six samples at concentrations ranging from 5.13 to 13.97 mg/kg. Thallium was detected in the sample at 4.85 mg/kg from 10.5 ft below grade. The reported results for all other metals in the samples were consistent with background soil concentrations of the metals at the INEEL. In the organic analysis, methylene chloride was detected in all of the samples at very low concentrations (less than 0.01 mg/kg). It was also detected in the method blanks. Trichloroethene was detected in the sample of soil from the dump truck at an estimated concentration of 4.6 μg/kg.

The SVOC analysis of the soil samples indicates the presence of a number of SVOCs that would be expected at the site, given the site history. These SVOCs included tributyl phosphate and some polyaromatic hydrocarbons, which are associated with combustion of kerosene. The detected compounds include tri-n-butyl phosphate, acenaphthene, phenanthrene, anthracene, fluoranthene, benzo(k)fluoranthene, and benzo(b)fluoranthane. The analysis indicated that the compounds are spectrally present but at concentrations below the sample quantitation limit. The "U" flagged sample quantitation limits, called the method detectable limit on the data reports, are what were reported for the compound concentrations in the data packages. Also detected in many of the samples were 3-nitroaniline, azobenzene, 2-methylphenol, bis(2-chlorethyl)ether, 2,6-dinitrotoluene, and numerous tentatively identified compounds. A number of other compounds, including naphthalene, 2-methylnaphathalene, 2-chloronaphthalene, acenaphthylene, dimethylphthalate, dibenzofuran, fluorene, diethylphthalate, carbazole, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-octylphthalate, were reported present in both the samples and the reagent blank.

Based on the 1995 soil sampling results, either the contamination was not totally removed from the site during 1983 demolition or the contamination is from a different source. The low levels of Cs-137 in the shallow soil samples could also mean that the soil used as backfill may have contained some contamination. The high Cs-137 concentration at the 10.5-ft depth is not consistent with the overflow of solvent caused by the stack condensate. The stack condensate making its way into the storage tank (LE-102) would have displaced the solvent upward, causing the solvent to flow through the surface flange of the tank. In addition, the 3 R/hr surface soil radiation readings observed at the release location would not be expected if the release consisted of solvent or stack condensate unless a larger volume was released and the soil adsorbed most of the radionuclides at or near the surface. The source of the contamination remaining at CPP-15 is not known.

To estimate the amount of remaining Cs-137 and Sr-90 activity at the site, available analytical data for the 1995 soil samples were used along with estimates of contaminant extent. The assumed area of contamination was 700 ft^2 extending to an arbitrary depth of 20 ft bgs, resulting in a volume of 14,000 ft^3. Credit for removed soil was not used because 1995 soil analytical data suggested the backfill had some contamination. Multiplying the volume by an average Cs-137 soil activity (293,022 pCi/g) resulted in 233 Ci using a 125 lb/ft^3 mass conversion for the soil. Doubling the Cs-137 activity to account for the Sr-90 activity results in a total Cs-137 and Sr-90 activity of 466 Ci.

Because the source of the contamination is not entirely understood for this site, the use of radionuclide ratios to establish a radionuclide source term may not be appropriate. The volume released to the environment and the type of waste (unevaporated or evaporative waste stream) are unknown. For these reasons, estimating the more mobile isotopes based on the Cs-137 concentrations found in the soils at CPP-15 may not be possible.

3.1.5 Sites CPP-27 and CPP-33

The contamination found at the CPP-27 and -33 release sites (Figure 3-25) is the result of liquid releases associated with a corroded 12-in. carbon-steel pressure-relief line running from the underground waste storage tanks to the INTEC stack. Two separate construction projects encountered contaminated soil during excavation activities, one in 1974 (CPP-27) and the other in 1983 (CPP-33). Since the contamination associated with both release sites is thought to have originated from the same corroded pressure-relief line, the leak mechanism and extent of contamination for both of these release sites are being combined into a single release site in this Work Plan.

The original design of the tank farm in 1951 provided two systems for handling off-gas from the storage tanks. The first system connected all but one of the waste tanks (i.e., WM-181) to the vessel off-gas system via a 4-in., stainless-steel, vent line and maintained a slight vacuum on the waste tanks. The second system, which was associated with the contaminant releases, consisted of pressure-relief valves installed on each waste tank vent line, which allowed high individual tank pressures to be relieved and vented to the INTEC stack via a 12-in., carbon-steel, pressure-relief line. The pressure-relief system was constructed of stainless steel from the waste tanks to and including the pressure-relief valve (located in a valve pit immediately adjacent to the tank vaults), and the system was carbon steel from the relief valves to the stack. Both of the waste off-gas systems were located underground, except for the final 40 ft of the 12-in. pressure-relief line, which exited the ground prior to its aboveground connection with the stack (Figure 3-25).

The 12-in. pressure-relief line reached its lowest underground elevation east of building CPP-604. This low point occurred just before the line rose aboveground for tie-in to the stack. A 2-in., stainless-steel, drain line was installed on the 12-in. line at the low point and directed to a 3-in. stainless-steel, INTEC stack drain buried 2.3 ft deeper (Figure 3-26). The drain permitted condensates forming in the pressure-relief line to gravity-drain into the 3-in. stack drain, which in turn flowed by gravity to a PEW holding tank (WL-102). In addition to this connection, however, forced-feed process waste-transfer lines from the WCF, the waste evaporator pump pit, and the waste solvent collection tank were tied into the stack drain near the vicinity of the 12-in. pressure-relief line drain. The pressures resulting from the force-feed transfer of waste in these lines resulted in corrosive solutions being forced into the 12-in., carbon-steel, pressure-relief line, which caused the line to corrode and ultimately leak.

The investigation concluded that the single most likely cause of the corrosion leak in the 12-in. carbon-steel line was the WCF waste-transfer line tie-in to the stack drain. Several lines of evidence were used to draw this conclusion. The WCF transfer line required higher steam jet pressures to make waste transfers, which likely forced waste liquid into the 12-in. pressure-relief line, although the pressure was sufficient in any of the three pressure waste systems to overcome the 2.3-ft height differential. Increases in stack activity were also noted during WCF transfers. Of the three waste streams that potentially entered the 12-in. pressure-relief line, WCF solutions were the most corrosive, because

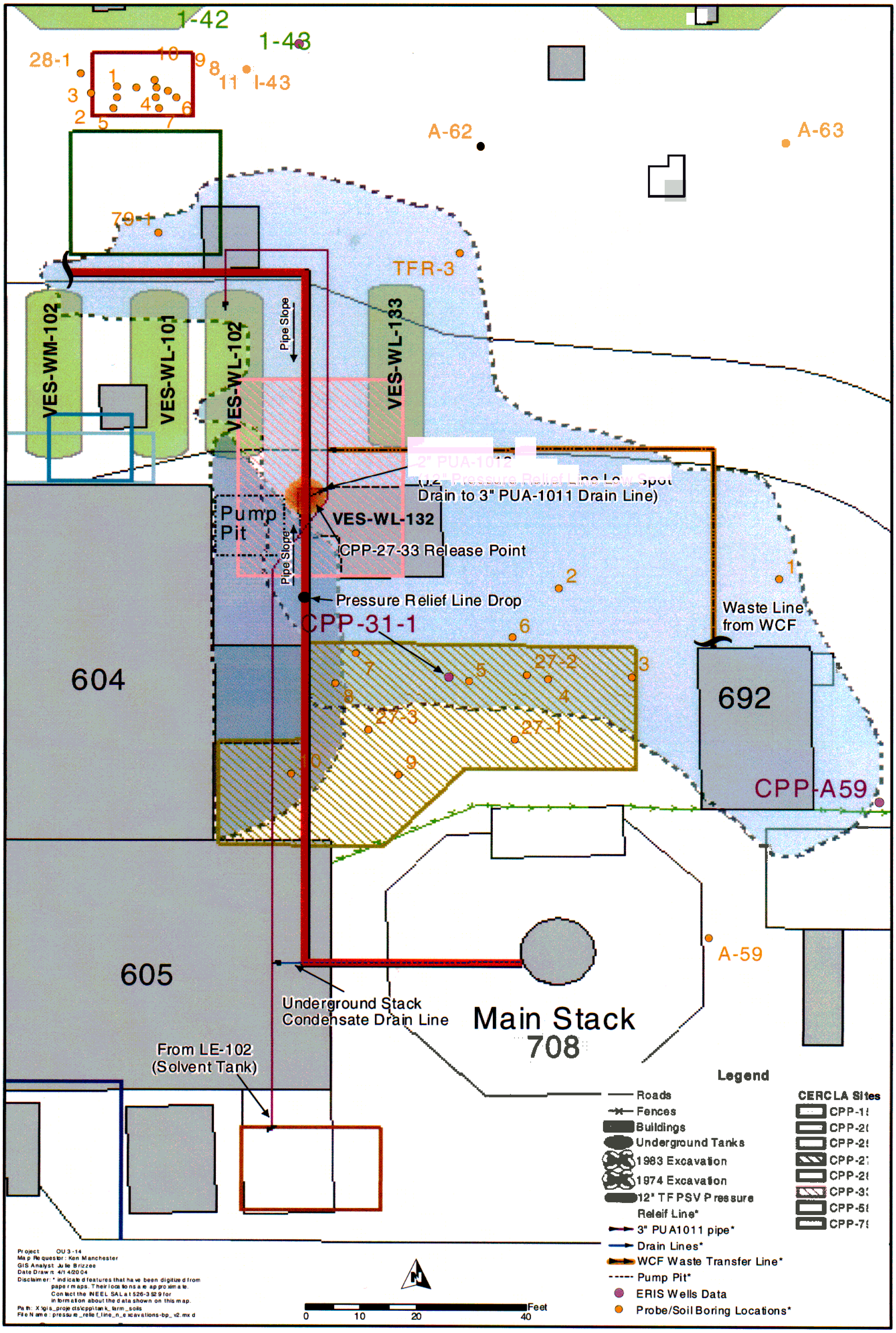

Figure 3-25. CPP-27/33 release sites showing location of 12-in. pressure relief line and associated piping, extents of excavation, and borehole/well locations.

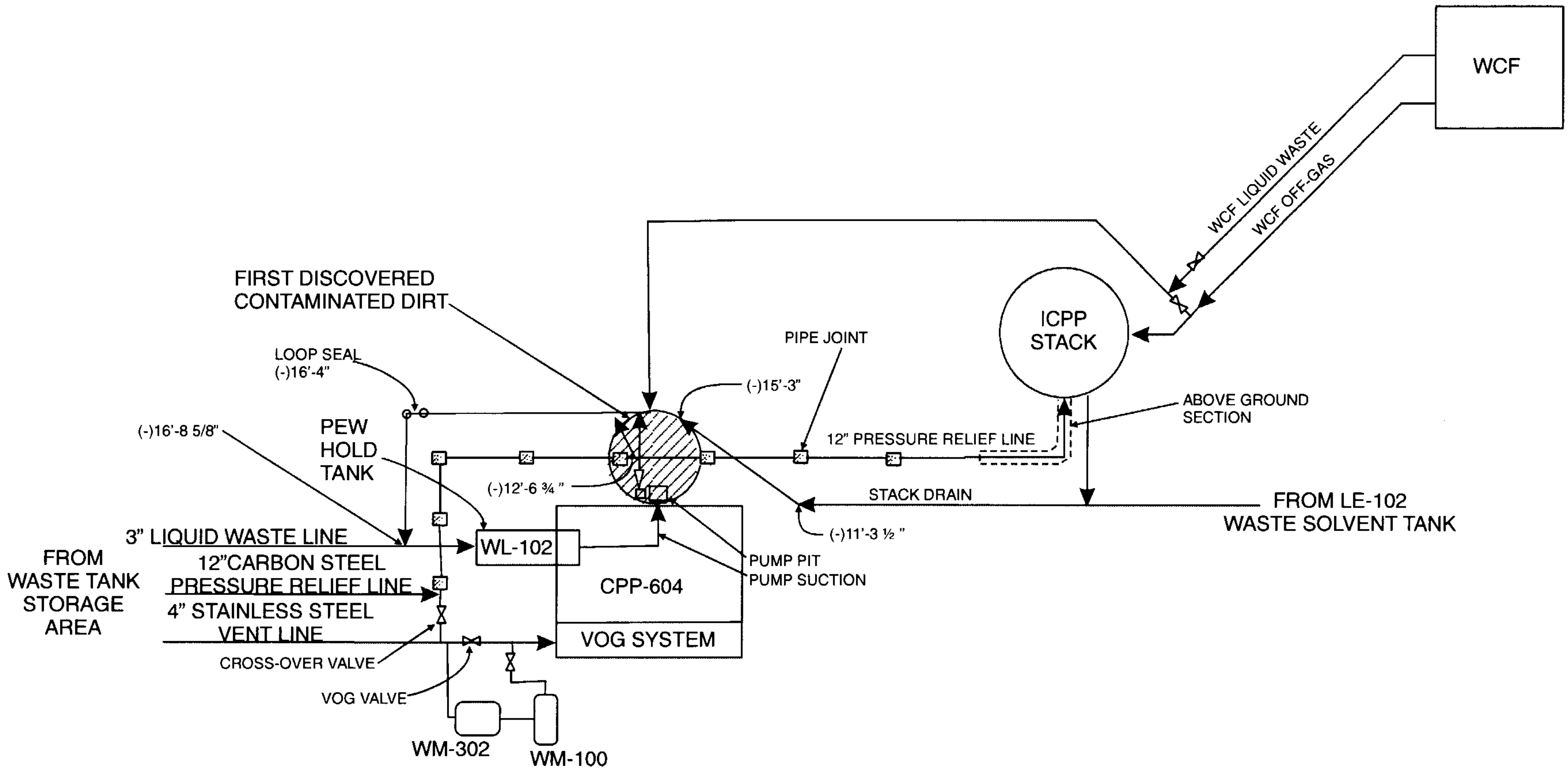

Figure 3-26. Schematic diagram showing piping layout in release area CPP-27/33.

they contained highly acidic decontamination and recycle solutions. In addition, WCF involved larger transfers of waste solution that were more frequent than those transferred in the other two lines.

A second corrosion mechanism was also identified that may have contributed to the failure of the 12-in. pressure-relief line. The crossover connection and valve between the 12-in. pressure-relief line and the 4-in. vent line was left open for 11 years due to an inaccurate as-built drawing, which allowed corrosive gas to flow through the pressure-relief line.

The investigation also concluded that all of the contamination came from the corroded 12-in., carbon-steel, pressure-relief line because the soil contaminant activity was traceable to the same area, activity levels were similar across the contaminated zone, radioisotope and chemical analyses found similar isotopic ratios at the major points, and no other leaking pipes or source terms were found.

On the basis of process knowledge, two types of waste are believed to have leaked at this location. From February 24, 1964, to August 30, 1974, approximately 115,000 gal of acidic waste solution that leaked onto the calciner cell floor during calcination of first-cycle aluminum waste (mostly from tank WM-185) were transferred from the WCF to the PEW collection tank. The concentration of Cs-137 and Sr-90 in this waste was estimated to be about 3,000 μCi/mL (3×10^{12} pCi/L). Less than 100 gal of this waste plus 100 to 300 gal of other waste (rain water, pump-leaked PEW solution, or water from the solvent hold tank) having considerably lower concentrations of radionuclides were estimated to have leaked to the soil. An estimated total of 1,000 to 3,000 Ci of activity was released.

In April 1974, during excavation of a construction site adjacent to and east of CPP-604, contaminated soil was first discovered (CPP-27) below a badly corroded and leaking 12-in., carbon-steel, pressure-relief line located 12 ft bgs. When excavation of the pipe was complete, the soil surrounding the corroded pipe had radiation readings up to 25 R/hr. The contamination leaked from a 7- to 8-ft section of corroded pipe into soil between the concrete joint support vaults and diffused vertically downward to a depth of 16 ft below the pipe (28 ft bgs) and laterally as far as 20 ft. The line was suspected to have been leaking since approximately 1961.

The contaminated soil was excavated and boxed and sent to the RWMC. This soil came from the area labeled as the 1974 excavation in Figure 3-25. A total of approximately 275 yd^3 of soil was removed from the site. Analysis of samples collected from the site in 1974 indicated Cs-134, Cs-137, Sr-90, Eu-154, Sb-125, Ru-106, and Pu-239/240 were present in the contaminated soil. Cs-137 activities in the four samples collected over nearly a 3-month period ranged from 2.89E+4 to 3.03E+6 pCi/g. The Sr-90 activities in three samples ranged from 9.45E+4 to 8.59E+4 pCi/g, and Pu-239/240 activities in two samples were 4.59E+2 to 2.97E+3 pCi/g. No other analyses are known to have been performed. After removal of the contaminated soil, only 25 mCi of radioactivity were estimated to be left at the site.

In 1983, additional contaminated soil attributed to the corroded line was encountered in the same general area while excavating soil to replace tank WL-102. This contamination is believed to be the result of the same release from the 12-in., carbon-steel, pressure-relief line. The contamination was designated as CPP-33 in the FFA/CO (DOE-ID 1991). During excavation activities, the clean soil (which may have ranged from background up to approximately 5 mR/hour based on personal communication with the project manager) was separated from contaminated soil for use as backfill once construction was complete. Approximately 14,000 yd^3 of contaminated soil were removed from the site (see Figures 3-27, 3-28, and 3-29). Of this total, approximately 2,000 yd^3 had contact beta-gamma radiation levels exceeding 30 mR/hr. This soil was removed and disposed of at the RWMC. The remaining 12,000 yd^3 were disposed of in trenches located in the northeast corner of INTEC. The excavated area was backfilled using the stockpiled clean soil and clean off-Site soil, and a portion of the area was covered by an asphalt road. WINCO (1993c) reported that some residual contamination remained below and to the sides of the

Figure 3-27. Photo showing the amount of soil removed from the CPP-27/33 release area during 1983 excavation (view looking west).

Figure 3-28. Photo showing the amount of soil removed from the CPP-27/33 release area during 1983 excavation (view looking south).